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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/965,904
Filing Date: September 28, 2001
Appellant(s): WALACAVAGE ET AL.

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Technology Center 2100

Daniel H. Bliss (32,398)
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 19 July 2007 appealing from the Office action mailed 14 February 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Jerry Banks, ed., "Handbook of Simulation", 1998, John Wiley & Sons, pages 519-545

Lee Schruben, "Simulation Modeling with Event Graphs", 1983, ACM, Communications of the ACM, vol 26 num 11, pages 957-963

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over "Handbook of Simulation," edited by Jerry Banks (Banks) in view of "Simulation Modeling with Event Graphs" by Lee Schruben (Schruben).

Banks discloses a programmable logic controller verification system [*"Control systems are implemented in software that runs material handling systems. The control system can be as large and complex as a warehouse management system (WMS) or as simple as the programmable logic controller (PLC) that controls a set of conveyor sections. In either case the control system contains decision-making logic that should be tested as early as possible in the design of the system. Many simulation tools include languages that can be used to replicate control system algorithms. Some simulation tools can actually communicate with control system*

programs directly to help test the code. The earlier that control system defects can be found, the better the material handling system will operate." (page 539, Section 14.3.6 Control Systems; entire Chapter 14)], comprising:

Writing a control model of the simulation entities [*"Many simulation tools include languages that can be used to replicate control system algorithms."* (page 539, Section 14.3.6 Control Systems)];

Testing as to whether PLC logic for the workcell is correct [*"In either case the control system contains decision-making logic that should be tested as early as possible in the design of the system... The earlier that control system defects can be found, the better the material handling system will operate."* (page 539, Section 14.3.6 Control Systems)]; and

Loading the PLC logic in the PLC controlling the workcell if the PLC logic for the workcell is correct and using the PLC logic by the PLC to operate the workcell [*"Some simulation tools can actually communicate with control system programs directly to help test the code."* (page 539, Section 14.3.6 Control Systems)].

Banks does not expressly teach constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations; and

Modeling the operator as an input to a programmable logic controller (PLC) by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart.

Schruben discloses constructing a flowchart that describes interaction of an operator in a workcell wherein such interaction comprises sequential operations and asynchronous operations [*"System Description: An operator is responsible for loading and unloading parts that are processed by a machine as well as freeing a jammed machine."* Sequential operations: *"The machine is loaded and unloaded requiring times t_l and t_u, respectively. The time required for the machine to cycle is t_c."* Asynchronous operations: *"The (random) machine run-time until the next time the machine jams is denoted by t_j. The (random) time required to repair a jammed machine is denoted by t_r."* (all from page 959, left column, first paragraph); Flowchart: *"FIGURE 2. Event graph for the Semiautomatic Machine System. Event vertices and state variables are defined in the text."* (page 959, right column, lower right corner)];

Schruben discloses modeling the operator as an input to a machine by writing a control model of the operator interaction in the workcell based on predefined conditions described in the flowchart [*"An operator is responsible for loading an unloading parts that are processed by a machine as well as freeing a jammed machine."* (page 959, left column); *"State variable definition, event definition, and edge conditioning usually proceed simultaneously in developing an event graph."* (page 960, left column, second paragraph); *"An event graph may be used to guide the development of an event-scheduling simulation program. For simple simulation models like the ones considered here, program development may proceed by visually checking the event graph to insure that the simulation model is logically "tied together." For more complex models, a system analysis of the event graph may be helpful."* (page 960, left column, third paragraph); Sections 3-3.4].

Schruben and Banks are analogous art because both are directed to the field of simulation of manufacturing systems.

Therefore it would have been obvious to a person of ordinary skill in the art at the time of Applicants' invention to include the operator and operator's interaction with the PLC-controlled machinery in the PLC logical verification system taught by Banks. This modification could comprise a "simulated operator" pushing a START or RESTART button on a PLC-controlled machine after "freeing a jammed machine".

The motivation for doing so is would be to more accurately model a real system of interaction between an operator and a PLC-controlled machine [*"In discrete-event digital simulation modeling, an analogy is created between a system and a computer program."* (Schruben, page 957, first paragraph); *"The next example is an extension of the first one. A service interruption is modeled here without the use of event canceling edges... We consider a single semiautomatic machine (so the event attribute of machine number can be dropped) that is subject to random jamming."* (Schruben, page 958, right column, Section 2.2)] and to make simulations easier to develop [*"Event graphs should make event-scheduling simulations easier to develop."* (Schruben, page 963, Section 5)].

Therefore it would have been obvious to a person of ordinary skill in the art at the time of Applicants' invention to combine the Schruben and Banks references to obtain the claimed invention.

Regarding claim 2, Schruben teaches that the step of testing comprises starting a timer and determining whether the operator interaction of the flowchart is completed within a

predetermined time [*"The (random) time required to repair a jammed machine is dentoed by t_r."* (page 959, left column)].

Regarding claim 3, Schruben teaches that the step of testing includes initializing the operator interaction of the flowchart prior to starting the timer [FIGURE 2, node 1, corresponding to Event 1 (page 959, right column)].

Regarding claim 4, Schruben teaches that the step of testing includes idling the operator prior to starting the timer [*"Parts arrive to be processed at (random) intervals of time of length t_a."* (page 959, left column); *"Event 1: (part arrival): $P = P + 1$, generate t_a."* (page 959, right column); The graph "idles" in the initial node until an event occurs].

Regarding claim 5, Banks teaches that the step of constructing comprises constructing a series of commands for the operator using the computer [*"Many simulation tools include languages that can be used to replicate control system algorithms."* (page 539, Section 14.3.6 Control Systems); entire Chapter 14].

Regarding claim 6, Schruben teaches that the operator has at least one resource [*"Every hour the operator is entitled to a five-minute break, but will take the time only after completing any partially finished work and unloading the machine."* (page 959, left column)].

Regarding claim 7, Schruben teaches that the resource has at least one capability [*"An operator is responsible for loading and unloading parts that are processed by a machine as well as freeing a jammed machine."* (page 959, left column)].

Regarding claim 8, Schruben teaches that the step of testing includes executing the commands when a timer is started [*"Parts arrive to be processed at (random) intervals of time of length t_a."* (page 959, left column); FIGURE 2; The graph and simulation are defined in terms of timed intervals during which the operator's instructions are executed.].

Claims 9 and 10 recite a combination of limitations found in claims 1 and 2. As claims 1 and 2 are obvious over Banks in view of Schruben, claims 9 and 10 are similarly obvious.

Claims 11 and 12 recite limitations corresponding to claims 3 and 4. As claims 3 and 4 are obvious over Banks in view of Schruben, claims 11 and 12 are similarly obvious.

Claims 13 and 14 recite a combination of limitations found in claims 5-7. As claims 5-7 are obvious over Banks in view of Schruben, claims 13 and 14 are similarly obvious.

Claim 15 recites a combination of limitations found in claims 9-14. As claims 9-14 are obvious over Banks in view of Schruben, claim 15 is similarly obvious.

(10) Response to Argument

In response to the rejection of claims 1-8, Appellants argue on pages 15-16 of the Brief that:

> In Schruben, there are discrete event simulations, which are time based, and cannot account for asynchronous operations. For example, the (random) time required to repair a jammed machine is modeled as a discrete or time based event because it is denoted by "t" and, therefore, cannot be an asynchronous operation.

The Examiner respectfully traverses this argument as follows.

Appellants' specification describes asynchronous behavior at page 3, line 11 through page 4, line 6, as follows:

> To model the proper behavior of a workcell to enable programmable logic controller (PLC) programs to be verified prior to the actual build/launch of tooling, it is necessary to account for the interaction of the operator in the workcell. This interaction consists of two segments: sequential operation where the operator functions as an integral part of the sequential cycle of the workcell, thereby causing certain logic conditions to be set in the PLC logic (ex: loading/unloading a part each cycle); and interrupt or exception behavior where the operator responds to asynchronous requests for the workcell. The premise in building the workcell model for simulation is that a user of a PLC logic verification system can perform all the necessary asynchronous functions without undue burden (for example, placing the machine into auto cycle). However, it would be difficult to be able to run the workcell through multiple continuous cycles if the user had to interact with the simulation throughout each cycle as if they were the real operator.

Therefore, where the operator loads or unloads a part from a machine is Appellants' example of the claimed "asynchronous operation". Appellants' specification further describes loading and unloading a part from a machine at page 10, line 8 through page 12, line 4 (emphasis added):

> Referring to FIG. 3., the method allows either the operator logic or PLC to test for status being returned from a resource through its input registers. The execution of the flowchart during simulation, which might be more than one based on different starting conditions, then proceeds by successive "command, test status" loops. The method begins with initializing the test in bubble 200. From bubble 200, the method advances to block 202 and idles the operator. For example, in block 202, the operator is set to idle where no work or motion is being performed. **From block 202, the method advances to block 204 and starts a timer. The timer may be set for a predetermined time period such as ten seconds to carry out the commands as illustrated in FIG. 4.** The user 12

> receives verification from the system 10 when the commands are completely performed. **The user 12 determines whether the commands are completed within the predetermined time period.** After block 204, the method advances to bubble 206 and ends. It should be appreciated that branching opportunities, reflecting testing multiple possibilities based on various status conditions, is also implemented. It should also be appreciated that controllers test conditions from resources or locations. It should be appreciated that the user can force conditions in the operator logic that allows diagnostic conditions to be verified.
>
> **Referring to FIG. 4, the method executes the commands when the timer is started.** The method begins in bubble 300 on the timer being started when called by block 204 of FIG. 3. From bubble 300, the method advances to block 302 and the operator gets, for example, a woodblock, which is a part. The method advances to block 304 and the operator takes the woodblock from a part source. The method advances to block 306 and commands the operator to put the woodblock. **The method advances to block 308 and the operator puts the woodblock at a first part location. The method advances to block 310 and commands the operator to push "cyclestart".** The method advances to bubble 312 and ends. It should be appreciated that the flowchart evokes resources and the user 12 can test the flowchart as to what is being tested is a PLC program loaded to the controller. It should also be appreciated the specific sequence of commands in FIG. 4 is merely an example of the commands executed.

Therefore Appellants' specification teaches that an "asynchronous operation" is exemplified by an operator loading or unloading a part, and further teaches that an operator loading or unloading a part is performed by **first starting a timer** and subsequently **timing the duration of the asynchronous operation.**

Turning to the Schruben reference, Schruben teaches precisely what is disclosed in Appellants' specification. For example, Schruben teaches on pages 958-959, section 2.2, "Example: A Semiautomatic Machine," that:

> The next example is an extension of the first one. A service interruption is modeled here without using event canceling edges. In fact, the author has found event canceling edges to be generally convenient in modeling but not necessary. We consider a single semiautomatic machine (so the event attribute of machine number can be dropped) that is subject to random jamming.

> System Description: An operator is responsible for loading and unloading parts that are processed by a machine as well as freeing a jammed machine. Freeing the machine requires that the part be unloaded. Every hour the operator is entitled to a five-minute break, but will take the time only after completing any partially finished work and unloading the machine. We assume that the operator will be able to take a break each hour (i.e., the time required to process a part or to free a jammed machine is much less than an hour).
>
> The (random) machine run-time until the next time the machine jams is denoted by t_i. The (random) time required to repair a jammed machine is denoted by t_r. Parts arrive to be processed at (random) intervals of time of length t_a. The machine is loaded and unloaded requiring times t_l and t_u, respectively. The time required for the machine to cycle is t_c. A single part at a time is processed. Partially completed work interrupted by the machine jamming will be finished once the jam has been corrected.

Here, Schruben clearly teaches the claimed "asynchronous operations" as described by Appellants' specification. The machine **randomly** becomes jammed and the repair procedure is modeled by requiring a **random** amount of time. These events are not rigidly scheduled as part of the normal operating procedure, but instead occur randomly for the specific purpose of modeling what Appellants' call "asynchronous" behavior.

Further, Appellants' allegations that Schruben fails to teach the claimed invention because Schruben teaches "discrete event simulations, which are time based" is not persuasive because Appellants' specification clearly teaches that "asynchronous operations" occur by **first starting a timer** and subsequently **timing the duration of the asynchronous operation**.

Therefore, the Schruben reference clearly teaches both the claimed limitation as well as the teachings found in Appellants' disclosure. Further, Appellants' attempts to distinguish the claimed invention from Schruben on the basis of "asynchronous operations being not time dependent" as recited by claim 1 are not supported by Appellants' disclosure.

Appellants further argue that:

> The passages from Schruben cited by the Examiner do not constitute constructing a flowchart that describes interaction of an operator in a workcell using a computer wherein such interaction comprises sequential operations and asynchronous operations, the asynchronous operations being not time dependent. In Schruben, an operator may be responsible for loading and unloading parts that are processed by a machine as well as freeing a jammed machine, but this operator interaction is <u>not</u> modeled by a flowchart. Further, there is no modeling of an operator as an input to a programmable logic controller (PLC).

The Examiner respectfully traverses this argument as follows.

In Schruben, page 959, Figure 2, shows the operator interaction modeled by a flowchart. The edges in Figure 2 are annotated with variables corresponding to the sequential and asynchronous operations of the operator described in section 2.2. For example, at state 4, the system may transition to state 11 along edge t_j indicating that the machine has jammed. After transitioning through stages 12 and 13, which model the asynchronous events of the operator freeing the jammed machine, the system transitions back to state 5 and proceeds along the normal course of operation. The sequential operations are similarly shown in Figure 2, for example, loading the machine in state 2. The states are described in detail above the figure.

Lastly, as is well known in the art and taught by Banks, a programmable logic controller (PLC) is the type of computer commonly used in machinery to receive input from front panel buttons and to control the machine's operation. Banks teaches on page 539:

> Control systems are implemented in software that runs material handling systems. The control system can be as large and complex as a warehouse management system (WMS) or as simple as the programmable logic controller (PLC) that controls a set of conveyor sections. In either case the control system contains decision-making logic that should be tested as early as possible in the design of the system. Many simulation tools include languages that can be used to replicate control system algorithms. Some simulation tools can actually communicate with control system programs directly to help test the code.

> The earlier that control system defects can be found, the better the material handling system will operate.

Therefore, in light of the combined teachings of the prior art as viewed by a person of ordinary skill, it would have been obvious to that person of ordinary skill in the art that a PLC controlled machine described by Banks should be tested as early as possible, and as taught by Schruben, both the sequential and "asynchronous" operations of the system should be tested.

Appellants appear to reiterate the allegations that the references are deficient on page 16 of the Brief. These allegations have been addressed above.

Appellants allege on page 17 that the combination of these references do not teach the claimed invention. The Examiner traverses this argument for the reasons set forth above.

Appellants reiterate the arguments presented for claims 1-8 in the context of claims 9-14 and 15. These arguments have been addressed above.

Appellants' arguments have been fully considered by the Examiner but have been found unpersuasive.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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10/9/2007

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